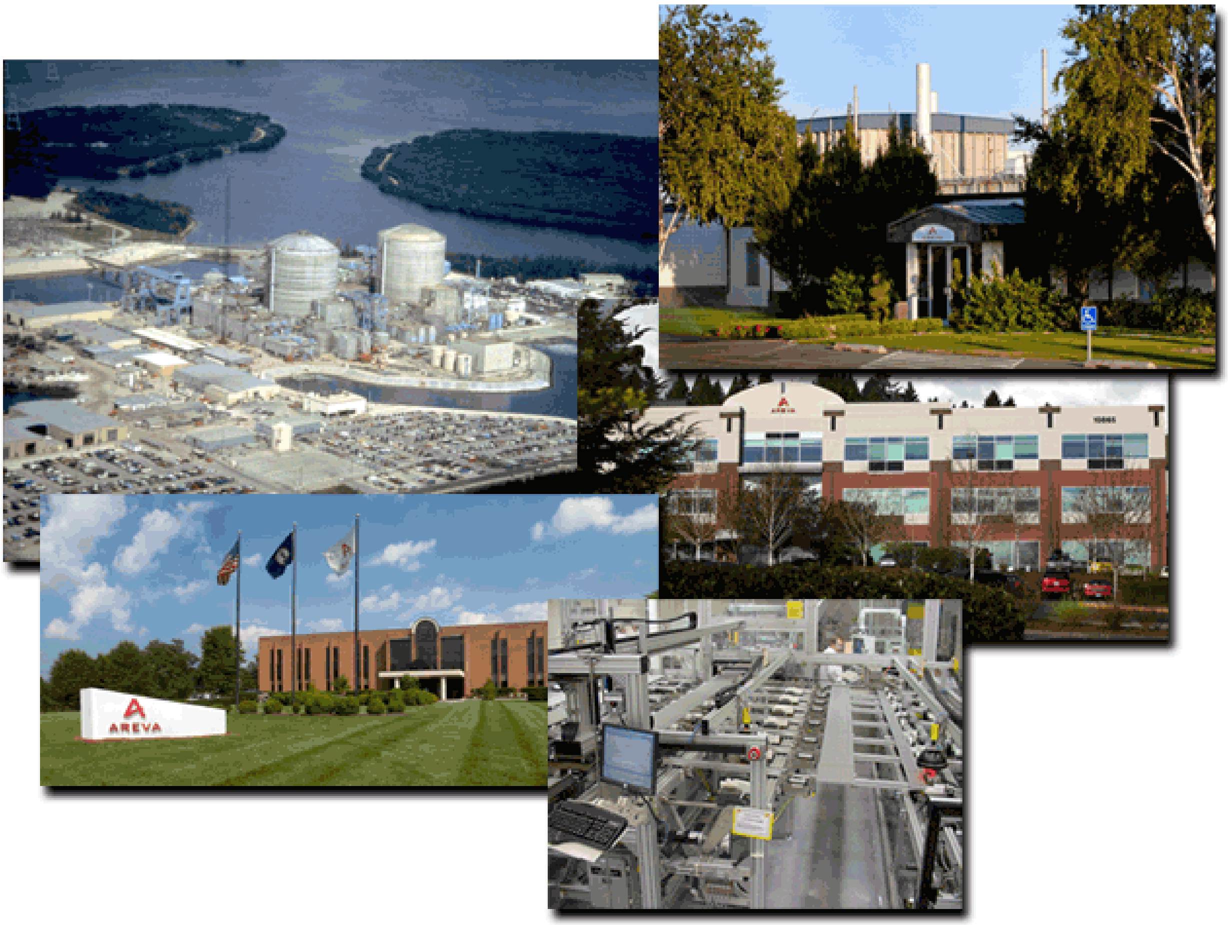
PRESS KIT

AREVA in the United States



Press contact:
Laurence Pernot
Tel : 001 301 841 1694
Fax : 001 301 841 1611
Julien Duperray
Tel: 33.1.34.96.11.47
Fax: 33.1.34.96.16.54
press@areva.com

December 2007

CONTENTS

Energy needs in the United States page 2

The revival of the U.S. nuclear program page 6

AREVA leader on the U.S. market for nuclear products and services page 13

AREVA, an integrated offer covering the entire nuclear energy cycle page 15

AREVA supports the revival of the U.S. nuclear sector page 16

A forward-thinking approach for AREVA's T&D division page 21

Annex: the EPR reactor page 24

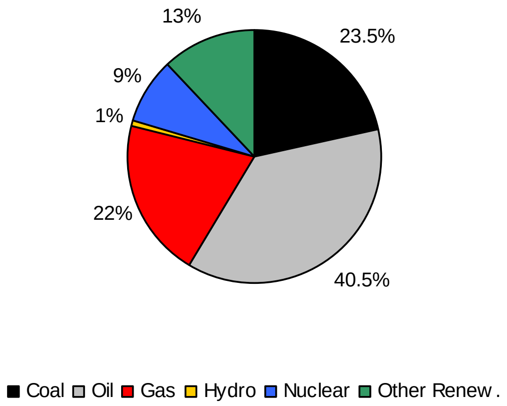
Main acronyms, References page 26

ENERGY NEEDS IN THE UNITED STATES

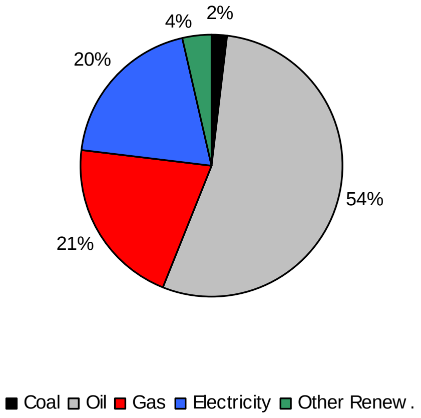
The U.S. energy context

In 2005, the United States had 297 million inhabitants (the 3rd most populous country in the world) and a land area of 9.4 million km^2 (17 times larger than France). With a GDP of 10,996 billion dollars (under the economic conditions of the year 2000), the U.S. is the largest economic power in the world. It is also the largest consumer of energy, with primary energy consumption of 2,329 million metric tons, meaning that 25% of the world's energy is consumed by just 4% of its population.

United States - Primary energy supply by source in 2005
Total : 2,329 Mtoe



United States - Final energy consumption by source in 2005
Total : 1,600 Mtoe



Energy security as a top priority

Although it has large domestic energy supplies, the U.S. is very far from achieving energy self-sufficiency. A decline of nearly 50% in oil production over a period of more than 30 years and the simultaneous stagnation of gas production have further weakened the U.S. energy balance. On a more general level, the increasing depletion of hydrocarbon resources (gas and oil), the concentration of the world's main resources in geopolitically unstable areas and the forecasted increase in the consumption and price of hydrocarbons, especially since 2005, mean that energy independence and supply security have become 2 of the top priorities of U.S. commercial and international policy.

Taking climate change into account

In 2007, the U.S. accounted for 22% of global CO_2 emissions, equaling those of China. In relation to population, the U.S. emits 8 metric tons/inhabitant compared to a world average of 4.2 metric tons/inhabitant. Although global warming is seen as a reality by the American public, it has only recently become a major argument in favor of a nuclear energy revival in the U.S. The context is, however, changing significantly.

This is evidenced by America's adoption, in recent years, of measures to reduce greenhouse gases, particularly through the development of new, more environmentally friendly technologies. Since 2001, nearly 23 billion dollars in public funds have been devoted to climate research and the development of clean energy sources, notably renewable energies such as wind and solar, but also hydrogen and nuclear. The trend in favor of "green energies" could accelerate and become a major source of economic growth in the coming years.

Fossil and fissile fuel resources

- **Petroleum**:

In 2006, the U.S. was the 3rd largest petroleum producer in the world with 310 million metric tons (8% of global production), behind Saudi Arabia (13% of global production) and Russia (12%). The U.S. holds 2.4% of the world's petroleum reserves.

- **Natural gas**:

In 2006, the U.S. was the 2nd largest gas producer in the world with 524,368 million m^3 (18% of global production), just behind Russia (22%). The U.S. holds 3% of the world's natural gas reserves.

- **Coal**:

In 2006, the U.S. was the 2nd largest coal producer in the world with 990 million metric tons (18.5% of global production), behind China (46%). The U.S. holds 27% of the world's coal reserves.

- **Uranium**:

In 2006, the U.S. held 10.5% of the world's known uranium resources exploitable at a cost of less than $130/kgU – estimated at 342,000 metric tons – and produced 1,650 metric tons of uranium (4% of global production).

Key figures

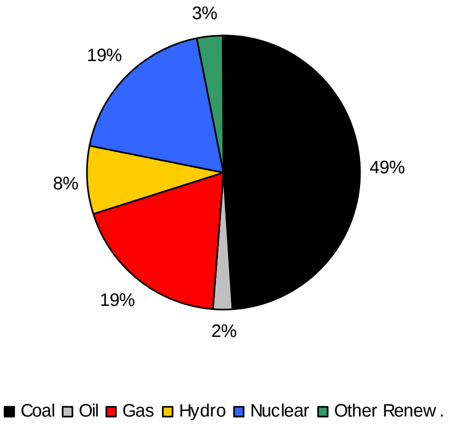
- Two thirds of the energy consumed in the U.S. is produced domestically; one third is imported.
- Forecasts indicate that demand for oil will increase by 44% by 2025, with imports expected to increase by 86% over the same period.
- The price per barrel of crude oil increased from 25 dollars in 2003 to 60 dollars in 2005, and reached nearly 90 dollars in October 2007.
- Industry and transportation account for 60% of energy consumption.
- Energy consumption has grown by 1.3% per year since the end of the 1980s.

High growth in electricity demand

Annual consumption varies from state to state but average per capita consumption exceeds 12,000 kWh (compared to 8,000 kWh for a family in France). According to the DOE, demand for electricity is expected to increase 50% by 2025.

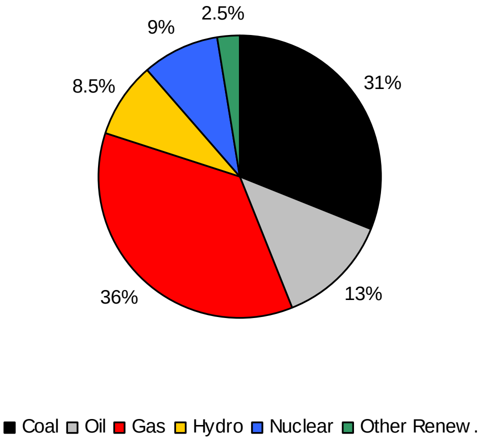
In 2006, the U.S. was the world's leading energy producer, producing 4,261 TWh (23% of global production) and consuming 3,820 TWh. Electricity production by source is as follows: 49% from coal (2,088 TWh, or 29% of global electricity production from coal, leading producer ahead of China), 19% from natural gas (810 TWh, or 23% of global electricity production from gas, leading producer ahead of Russia), 19% from nuclear energy (810 TWh, or 28% of global electricity production from nuclear, leading producer), 8% from hydroelectric (341 TWh, or 10% of global hydroelectric production, 4th largest producer after China, Brazil, and Canada), 2% from oil (85 TWh), and 3% from other renewable sources (128 TWh).

United States - Electrical power generation by source in 2006
Total : 4,261 TWh

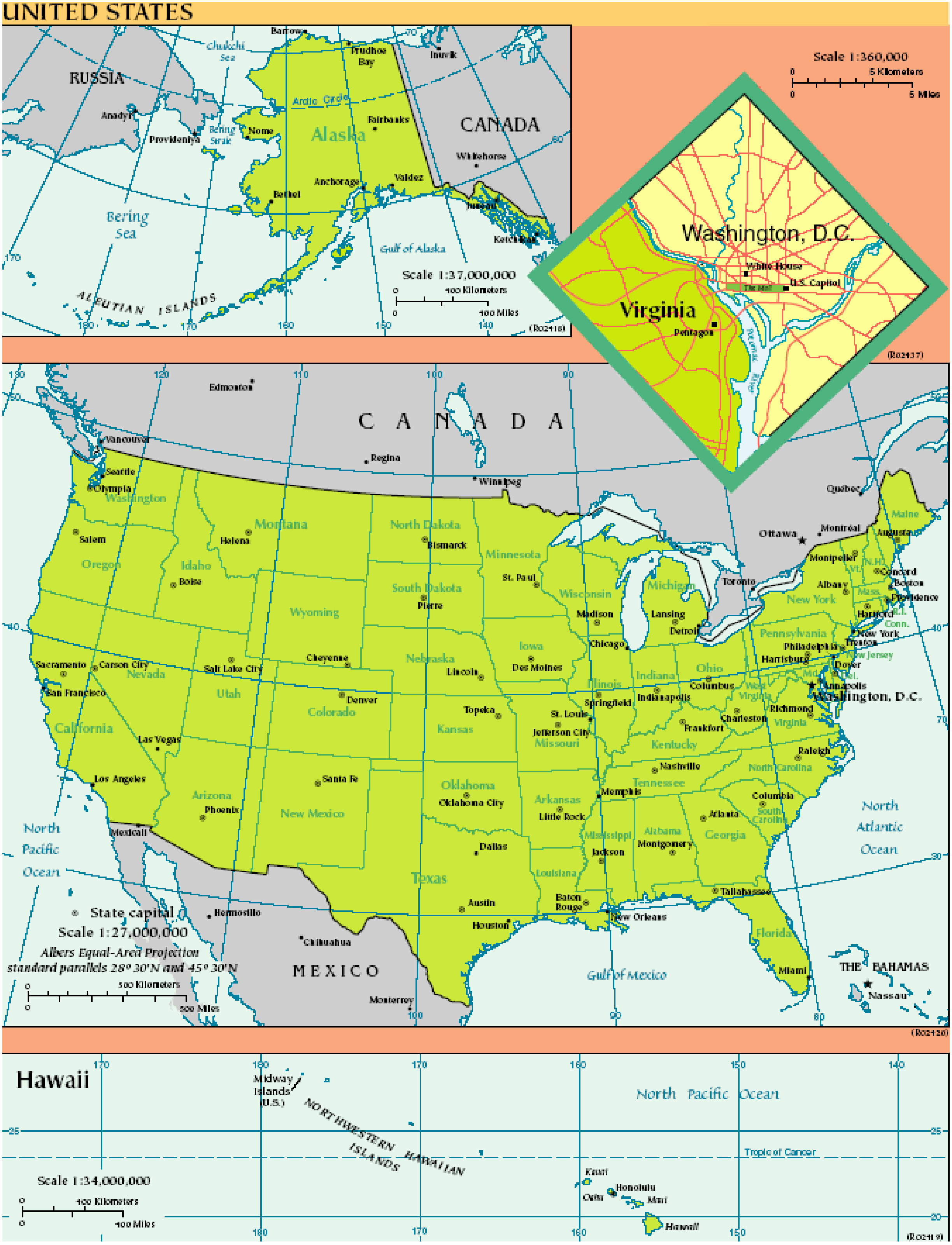


In 2006, installed electrical capacity, that is, the combined electrical power from all means of production, was 1,094 GWe. This figure can be broken down as follows: 31% from coal (338 GWe), 36% from natural gas (395.5 GWe), 13% from oil (142 GWe), 9% from nuclear (99 GWe), 8.5% from hydroelectric (92 GWe) and 2.5% from renewable energies (26.5 GWe).

United States - Installed electrical capacity in 2006
Total : 1,094 GWe



Map of the United States of America



THE REVIVAL OF THE U.S. NUCLEAR PROGRAM

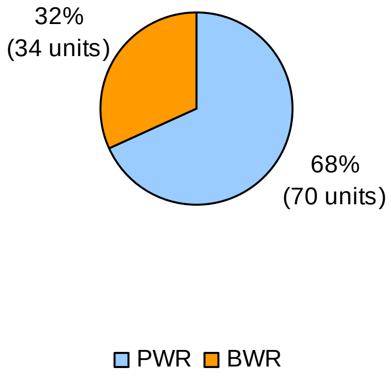
The nuclear power situation in the United States

In 2007, the United States have 104 nuclear reactors with a total installed capacity of 100,3 GWe. The technology was split as follows: 34 boiling water reactors (BWR) with a capacity of 32 GWe and 70 pressurized water reactors (PWR) with a capacity of 68 GWe. Nuclear reactors are located in 31 of the 50 states, mainly in the eastern half of the country.

On December 31st, 2006 nuclear power generated 810 TWh, or 19% of total electrical production. Installed nuclear capacity represented 9% of the country's total electrical capacity. In 2006, 103 nuclear reactors were connected to the grid, compared to 104 nuclear reactors in 2007: after a long shutdown, Browns Ferry 1 reactor (PWR, 1 065 MWe) has been re-connected to the grid on June, 2nd, 2007.

The nuclear power plants in the United States' fleet have an average age of 26 years. The oldest power plants that are still in service are Nine Mile Point 1 and Oyster Creek (both use BWR technology), which began operations in December 1969. Watts Bar 1 (PWR technology) is the newest nuclear power plant, having commenced operations in 1996.

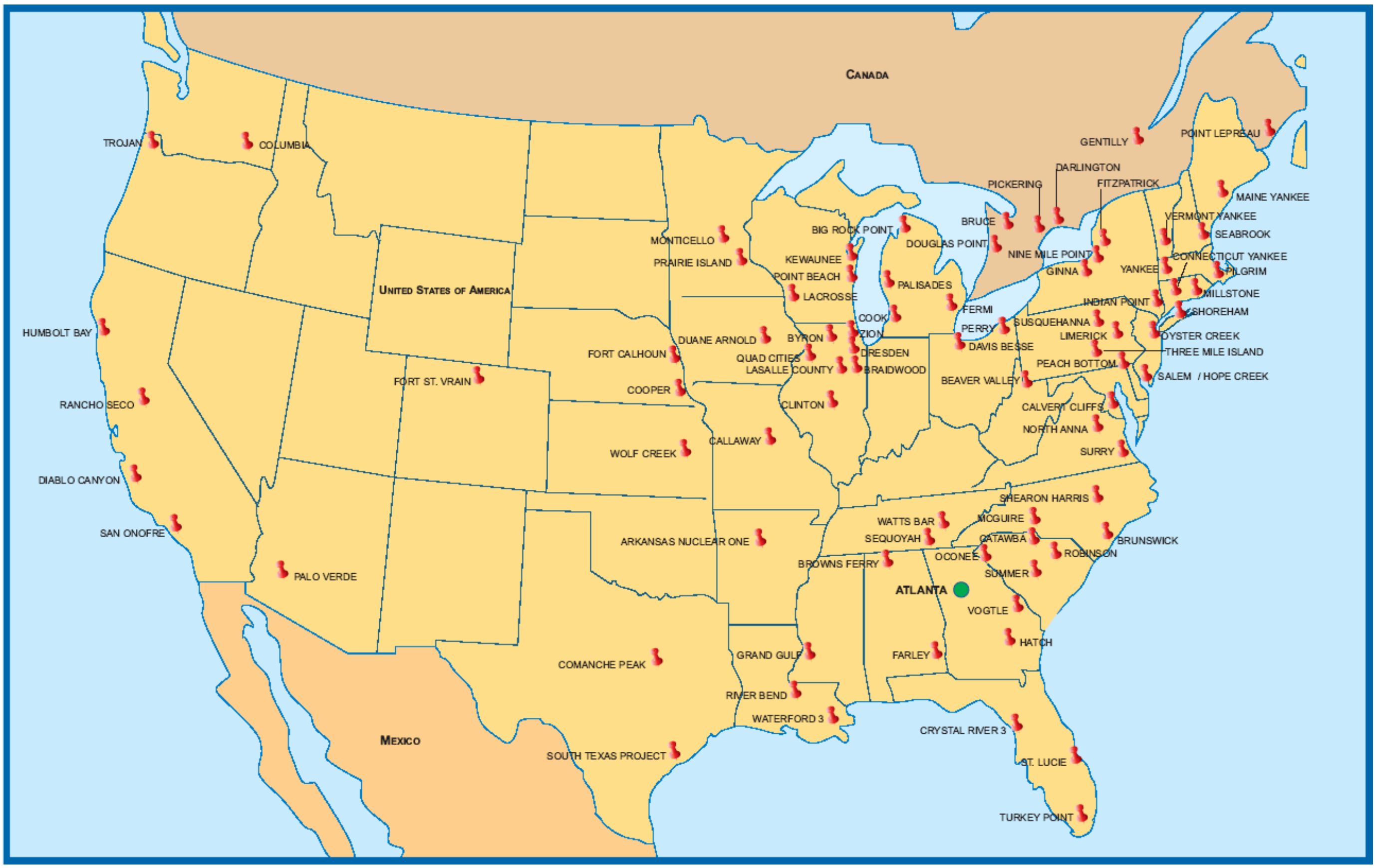
United States – Breakdown of installed nuclear capacity
by reactor technology connected to the grid in 2007
Total : 100.3 GWe (104 reactors)



Key figures

- In the United States, the release of 700 million metric tons of CO_2 is avoided every year through the use of nuclear power. This corresponds to 94% of the emissions from the 138 million vehicles on the road in the U.S.

Map of nuclear power plants in the United States
(January 2006)



source : WANO (World Association of Nuclear Operators), 2007

A successful and competitive U.S. nuclear industry

Although energy consumption has continued to grow, the contribution of nuclear power to the energy mix has remained steady despite the lack of new construction. This is mainly due to continuous performance improvements in reactor safety and availability.

These performance improvements are, to a great extent, due to the deregulation of the U.S. electricity market in the 1990s and subsequent mergers and acquisitions, which led to a consolidation in the number of operators. The economies of scale achieved and the major investments made possible by the pooling of resources promoted the continuous improvement of reactor operations while reducing reactor operating and maintenance costs.

Key figures

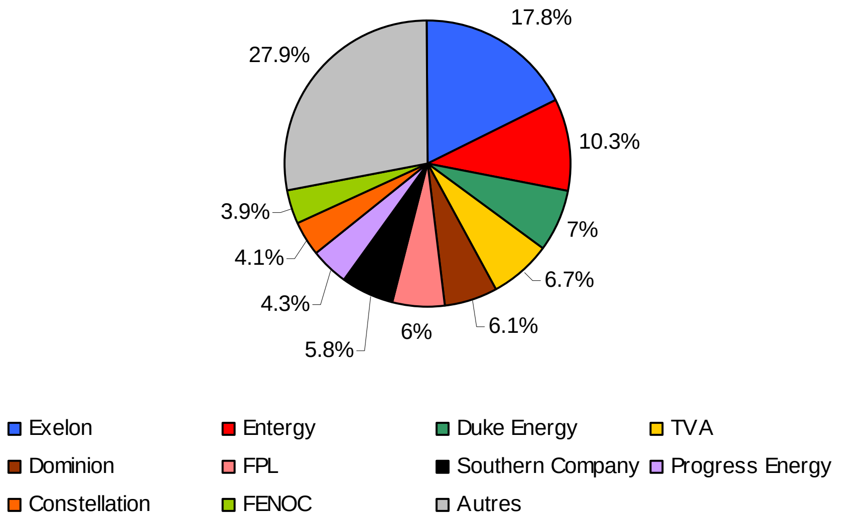
- In 2007, 104 reactors connected to the grid were operated by 27 companies.
- In 2005, 7 utilities controlled 64% of the U.S. electricity market: Exelon (20.7%), Entergy (9%), Constellation (8.9%), Duke (7%), Southern Co. (6.1%), Dominion (6%) and TVA (5.9%). The top 4 held 45% of the market. All of these companies operate in the eastern half of the United States.

The 10 leading U.S. utilities operating nuclear plants in 2006 were:

Company name	**Installed capacity (MWe)**	**Number of reactors**
Exelon	17,709	17
Entergy	10,189	11
Duke Energy	6,996	7
TVA	6,695	6
Dominion	6,025	7
FPL	5,915	8
Southern Company	5,771	6
Progress Energy	4,323	5
Constellation	4,074	5
FENOC	3,888	4
Total of top 10	**71,585**	**76**
Others	27,672	27

Source: NUKEM Market Report, October 2007
FPL: Florida Power & Light Co.
FENOC: First Energy Nuclear Operating Co.

United States – Breakdown of installed nuclear capacity
by major utilities operating nuclear reactors connected to the grid in 2006



Since the late 1990s, the average availability factor for U.S. reactors has continued to rise, stabilizing at around 90%. This performance is clearly related to a steady reduction in the duration of reactor outages for refueling. The average outage time went from over 100 days in the early 1990s to less than 40 days in recent years.

Key figures

- The increase in the availability of U.S. reactors over the last 15 years is equivalent to the construction of 26 new 1,000 MWe reactors.
- 60 requests for operating license extensions for reactors currently in operation have been submitted to the NRC; more than two thirds have already been approved.

The first steps towards the revival of the American nuclear program

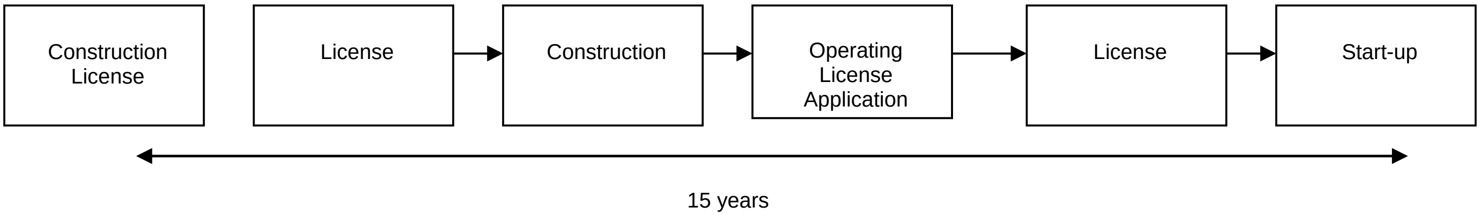
In June 2005, George W. Bush went to Maryland to tour the Calvert Cliffs nuclear plant. His visit had symbolic value: it was the first time in 26 years that a president had visited a power plant and sent a public message about his determination to revive the civilian nuclear power program, which had been wound down by the Carter Administration in 1979. The speech was followed by decisions:

- **The Energy Policy Act, which encourages investment in non-CO_2 emitting technologies, was passed on August 8, 2005**. Among other things, the Energy Act includes incentives for utilities to build new reactors. Those incentives include a program of federal aid in the form of tax credits and loan guarantees for the first 6 reactors built, as well as insurance against “regulatory risks” that should cover expenses caused by any licensing delays for a new project (capped at 500 million dollars per reactor).

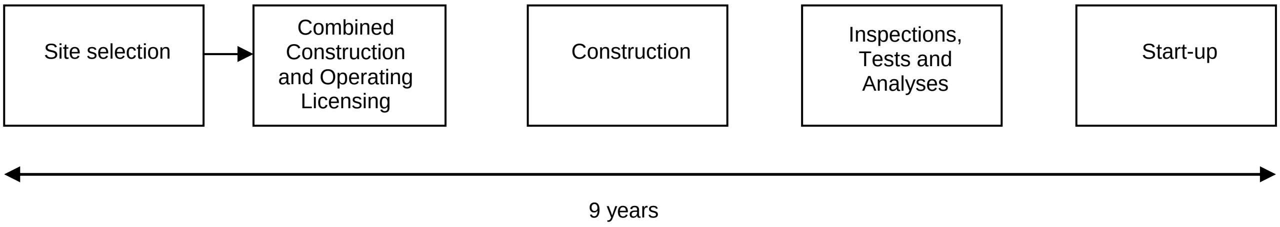
  In this favorable environment, the U.S. Administration and the nuclear industry have implemented very active recruitment programs. The Nuclear Regulatory Commission (NRC) alone has hired almost 300 engineers and technicians each year for the past 3 years in anticipation of demand for new reactor construction and operation.

- **A simpler, expedited licensing process for reactor construction and operation, which limits the risk for utilities**.

Yesterday’s process…



… and today’s process


Site selection
Combined Construction and Operating Licensing
Construction
Inspections, Tests and Analyses
Start-up
9 years

- **New reactor construction projects announced by utilities**.

  More than 30 projects are underway, of which almost half are the subject of a Construction and Operating License (COL) application to the NRC. According to the report published in February 2007 by the EPRI, installed nuclear power in the United States could have increased by 64 GWe in 2030 and by 24 GWe in 2020.

  It should be noted that the utilities' current projects are technological decisions regarding reactor types and do not constitute confirmed orders.

Utility	Sites, States	Technology (number of units)	Estimated date of COL application
Alternate Energy Holdings	Bruneau, Idaho	EPR (1)	2009
Amarillo Power	Vicinity of Amarillo, Texas	EPR (2)	2009
AmerenUE	Callaway, Missouri	EPR (1)	2008
Constellation (UniStar)	Calvert Cliffs, Maryland Nine Mile Point, New York	EPR (2)	2008
Detroit Edison	Fermi, Michigan	To be confirmed (1)	2008
Dominion	North Anna, Virginia	ESBWR (1)	2008
Duke	William State Lee, South Carolina	AP 1000 (2)	2008
Duke	Davie County, North Carolina	To be confirmed (1)	To be confirmed
Duke	Oconee County, South Carolina	To be confirmed (1)	To be confirmed
Entergy	River Bend, Louisiana	ESBWR (1)	2008
Entergy (NuStart)	Grand Gulf, Mississippi	ESBWR (1)	2008
Exelon	Clinton, Illinois	To be confirmed (1)	To be confirmed
Exelon	Matagorda and Victoria County, Texas	To be confirmed (1)	2009
Florida Power & Light	Turkey Point, Florida	To be confirmed (2)	2009
NRG Energy/STPNOC	Bay City, Texas	ABWR (2)	2008
PPL Corp.	Susquehanna, Pennsylvania	EPR (1)	To be confirmed
Progress Energy	Harris, North Carolina; Levy County, Florida	AP 1000 (2); AP 1000 (2)	2008
South Carolina Electric and Gas	Summer, South Carolina	AP 1000 (2)	2008
Southern Company	Vogtle, Georgia	AP 1000 (2)	2008
Texas Utilities	Comanche Peak, Texas	APWR (2)	2008
TVA (NuStart)	Bellefonte, Alabama	AP 1000 (2)	2008

Source: Nuclear Energy Institute, Insight, August/September 2007.
EPR: PWR technology by AREVA
ESBWR: BWR technology by General Electric
ABWR: BWR technology by General Electric
AP 1000: PWR technology by Toshiba/Westinghouse
APWR: PWR technology by Mitsubishi

The United States encourages and provides financial support to major international development programs relating to the nuclear energy cycle

In particular, the DOE supports the following international programs:

- GNEP (Global Nuclear Energy Partnership), which promotes nuclear energy and global cooperation through the deployment of advanced nuclear technologies which are more efficient, reduce waste, save resources and limit proliferation.
- GIF IV, the R&D program for the 4th generation of reactors.

Uranium conversion: the main uranium conversion plant is operated by CONVERDYN at the Metropolis site (Illinois). The plant has an annual production capacity of 14,000 metric tons of uranium.

Uranium enrichment: USEC operates the Paducah plant (Kentucky), which has an annual production capacity of 8 million SWU (Separative Work Units) and uses gaseous diffusion technology. This is the main enrichment plant currently operating in the United States.

In April 2007, the NRC granted USEC a license to build and operate an enrichment plant based on ultracentrifugation technology. The plant, the American Centrifuge Plant at Piketon (Ohio), will use ultracentrifugation technology perfected by the DOE. The license was granted for enrichment up to 10%. The Piketon site should start operating around 2009 and will reach production capacity of 3.8 million SWU around 2012.

The National Enrichment Facility, a uranium enrichment plant using ultracentrifugation technology, is under construction at the Eunice site (New Mexico). This project involves the Louisiana Energy Services partnership created by Urenco, Exelon, Duke Power, Entergy and Westinghouse. Production should begin in 2009 and reach full production capacity of 3 MSWU/year in 2013.

Manufacturing of nuclear fuel assemblies: 4 plants are responsible for manufacturing most UO_2 nuclear fuel assemblies.

Names of nuclear fuel manufacturing plants in the United States	Type of reactor in which the fuel will be used	Production capacity (metric tons/year)
Lynchburg (Virginia)	PWR	600 mt/year
Columbia (Maryland)	PWR	1,100 mt/year
Richland (Washington)	BWR	700 mt/year
Wilmington (North Carolina)	BWR	1,350 mt/year

(AREVA plants in bold)

At the back end of the fuel cycle, American policy on the management of spent nuclear fuel is undergoing significant change. The back end market in the United States is different to that in Europe and focuses primarily on:

- Dry storage of spent fuel at the reactor site, a market in which AREVA is the clear leader.
- Clean-up and dismantling of sites that are no longer in operation.

Since 1977, the United States has not recycled spent nuclear fuel. Instead, it has been stored in fuel storage pools. The DOE has been responsible for managing this waste since 1998. Utilities pay a tax on the production of nuclear electricity which is intended to cover the cost of managing spent fuel. Until recently, the policy relating to the management of the back end of the nuclear fuel cycle stated that spent fuel should, immediately after leaving the reactors, be stored at the geological storage center at Yucca Mountain (Nevada). A combination of repeated construction delays, capacity constraints and social objections to this project, alongside an increased awareness of the advantages of recycling on the part of the American government, have resulted in a clear reevaluation of the back end fuel cycle management policy, which now centers on the processing and recycling of spent nuclear fuel.

The "Global Nuclear Energy Partnership" (GNEP) – An international project to create a world fuel bank

The GNEP program, introduced by the Bush Administration in February 2006, is an international cooperation project dedicated to the controlled expansion of nuclear power around the world. It aims to boost the nuclear industry, meet increasing needs for energy and reduce the energy dependence of the U.S. while limiting greenhouse gas emissions and the risks of proliferation. This program would see the introduction of spent fuel recycling in the United States.

The decision to manage spent fuel through recycling would, if adopted, mark a major turning point in American policy. This change of heart is primarily due to the fact that recycling offers the potential to make use of the energy contained in spent fuel[1], an approach that is increasingly attractive in a context where natural resources are becoming increasingly rare and the country's energy dependency needs to be reduced. The change can also be explained by the configuration of the Yucca Mountain site (due to open in 2018), which is already too small to store the waste produced to date. Reprocessing would make it possible to dispose of 4 to 5 times as much final waste and would avoid the need to construct a new disposal site before the end of the century.

Key figures for the back end of the cycle in the United States

- An average of 2,000 metric tons of fuel is unloaded each year across the U.S. fleet.
- 54,000 metric tons of spent fuel have been produced in the last 40 years and are now stored at the reactor sites pending a final and lasting solution. If recycled, this spent fuel would guarantee energy supplies to U.S. reactors and produce around 7 years' worth of electricity.

With regard to the dismantling of reactors, the United States is, alongside France, one of the most active countries. 28 reactors have been closed and dismantled or are being dismantled. Although these are mainly research reactors with relatively limited power, this number also includes 10 high-power commercial reactors (mainly over 2,000 MWth, of which 8 PWR and 2 BWR).

In terms of non-proliferation, the United States is a nuclear power and a signatory to the Treaty on the Non-Proliferation of Nuclear Weapons ratified in 1970. The rules and obligations defined by the IAEA with regard to non-proliferation are applied to all civil nuclear installations located on American soil.

---

[1] After supplying electricity for 3 to 5 years in the reactor, 96% of the spent fuel can still be reused – 95% uranium and 1% plutonium – by recycling it into fresh fuel. The remaining 4% is end waste (not recyclable given current technological and economic constraints).

AREVA LEADER ON THE AMERICAN MARKET FOR NUCLEAR PRODUCTS AND SERVICES

The American energy and electricity market is a strategic market for the AREVA group. It is destined to grow substantially and is also a standard bearer, as energy decisions made by the United States can influence decisions made by other countries and customers.

AREVA's strong position in the United States is long-standing. The group is currently the leader in the U.S. market for nuclear products and services (ahead of "historical" leaders such as General Electric, Westinghouse and USEC), not only in terms of sales revenue, **which has tripled in 5 years**, but also in terms of number of employees. This is the result of a deliberately aggressive strategy.

In 2006, AREVA hired almost 400 people in the United States, including 350 people for the Plants division, primarily to ensure that the U.S. EPR model obtained NRC certification and to prepare the first COL applications. The group is expecting to hire another 400 people in 2007 and almost 200 per year over the next 5 years in the fields of mechanical engineering, nuclear engineering, chemistry, welding, electronics and information technology.

AREVA has invested almost 200 million dollars in EPR certification alone. This is in addition to the 160 million dollars invested in the modernization of its industrial equipment over the last 4 years.

Furthermore, AREVA, through its subsidiary CANBERRA since 2001, is the world leader in the supply of nuclear measurement safety and security solutions. Founded in the United States 40 years ago, CANBERRA has, since 2001, been developing its activities to cover the full range of nuclear measurement applications, systems and services. The company's head offices are in Meriden (Connecticut).

CANBERRA's main product and service lines cover:
- Homeland security: fixed, mobile or portable detection technologies and products that rapidly detect the presence of radioactive materials;
- Defense: protection solutions for a variety of applications;
- Non-proliferation: equipment that contributes to the international fight against the proliferation of nuclear weapons;
- Laboratories and plants within the cycle: specialized equipment for gamma and alpha spectroscopy, alpha-beta counting, criticality detection, non-destructive testing, the measurement of waste radioactivity and environmental and sanitary surveillance.
- Nuclear power plants: a range of solutions for the surveillance of material and environmental contamination, in vivo measurements and waste classification.

CANBERRA has 3 production and engineering plants in the United States: in Albuquerque (New Mexico), Oakridge (Tennessee) and Meriden (Connecticut). CANBERRA also has 9 production and engineering plants in France, England, Canada and the Benelux region.

With more than 1,000 employees, CANBERRA is able to provide AREVA clients with the best technological solutions.

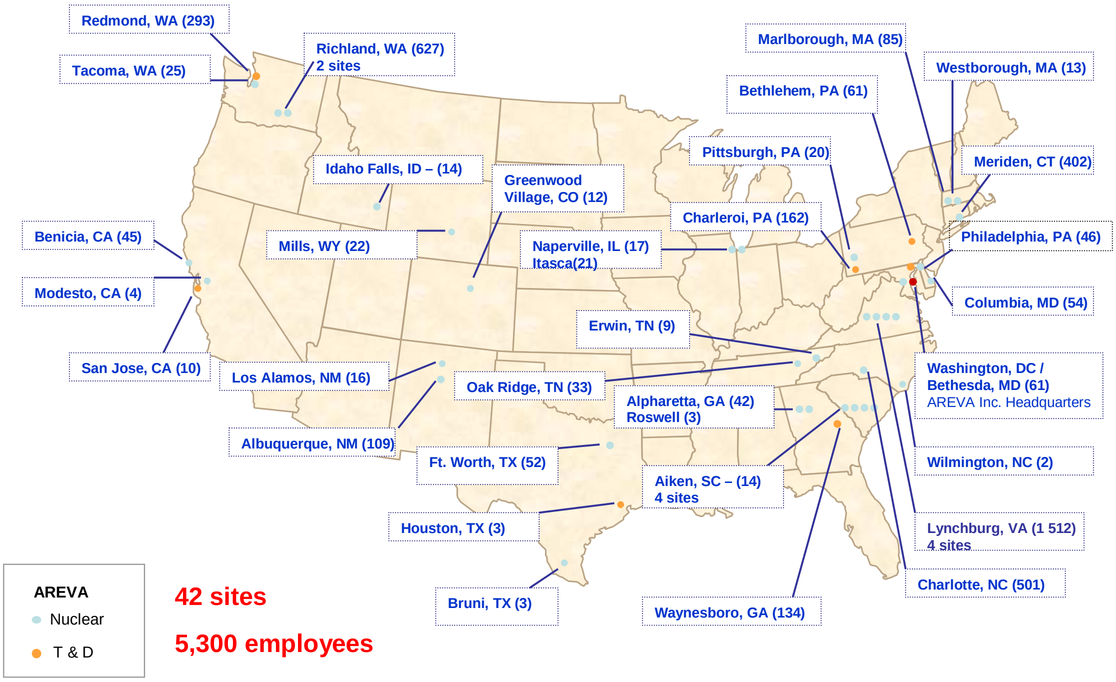
In addition, AREVA, through its subsidiary TN International, is the leader on the American market for the interim storage of spent fuel (pending a final disposal solution, utilities store their spent fuel at their reactor sites). More than 50% of this fuel is in dry storage systems supplied by AREVA.

The clean-up of nuclear sites undergoing dismantling is another strong business opportunity. Of note is the DOE's decision to award a contract to the Group for the retrieval and packaging of legacy waste stored at the Hanford site (Washington State).

Key figures for AREVA in the United States

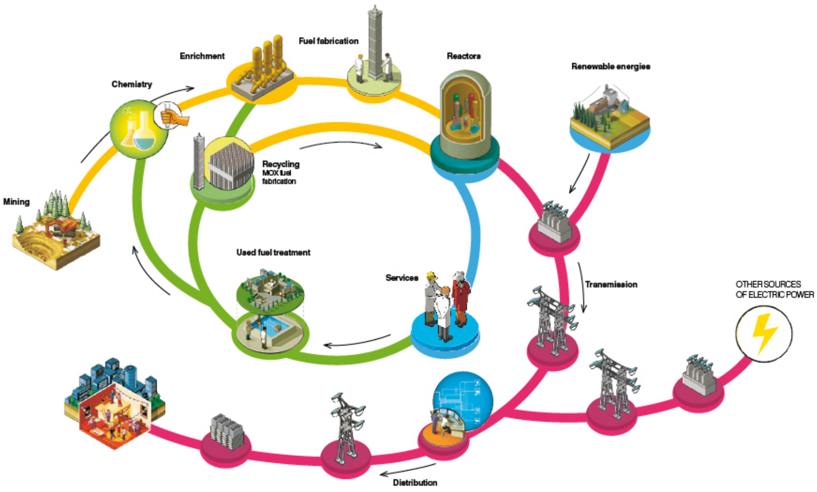
- Almost 1.7 billion dollars in sales revenue in 2006 (tripled in 3 years).
- More than 5,000 employees.
- 42 sites, both industrial and commercial, in 20 states.
- Supplier of almost half of all steam generators, pressurizers, and reactor vessels head replacements.
- CANBERRA, the AREVA subsidiary specialized the supply of nuclear measurement solutions for safety and security and the world leader in its field, has been present in America since 1965.
- AREVA controls 25% of the American market for PWR fuel.
- Almost 50% of all nuclear waste transportation is handled by TN International, an AREVA subsidiary.

Map of AREVA's sites in the United States



AREVA, AN INTEGRATED OFFER COVERING THE ENTIRE NUCLEAR ENERGY CYCLE

AREVA is active in every stage of the nuclear cycle. It is the only group able to offer its customers integrated, global products and services, giving it a real competitive advantage.



Market share by division within the AREVA group

Division	Market share	Competition
Front End	20%	USEC, URENCO, Toshiba/Westinghouse, CAMECO
Reactors and Services	28%	Toshiba/Westinghouse, GE, MHI
Back End	3% AREVA is leader in the dry storage market	Bechtel, Fluor, WGI, BWXT
T&D	4%	ABB, Siemens

AREVA SUPPORTS THE REVIVAL OF THE U.S. NUCLEAR SECTOR

The Front End Division – The main business in terms of local volume

In terms of sales revenue, the Front End is AREVA's leading business division in the United States. The Group supplies utility clients with all associated products and services: extraction and concentration of uranium ore, conversion and enrichment services and fuel manufacturing.

At present, fuel fabrication is the only operation conducted in the United States and has 2 production plants located in Lynchberg (Virginia) and Richland (Washington). Other services are supplied by AREVA units around the world.

URENCO centrifuges

Key figures

- 20% of the American uranium market is held by AREVA.
- 30% of American plants currently use fuel supplied by AREVA.
- AREVA has invested 50 million dollars to install 2 new fabrication lines in its Lynchburg and Richland plants.

Towards the construction of an enrichment plant in the USA

AREVA intends to strengthen its positions in the enrichment market, specifically through the construction of a uranium enrichment plant on American soil.

Based on the consumption of the 104 reactors in service in 2007, US demand for enrichment services (in SWU) averages 14.5 million per year and is expected to reach around 17 million in 2020.

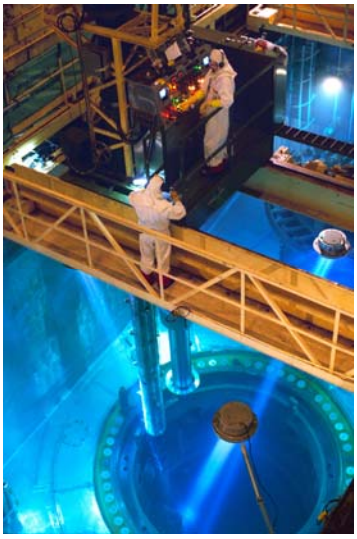
Almost 50% of this demand is met by Russia and comes from highly enriched uranium from defense origins. The contract with Russia will end in 2013 and is not expected to be renewed. This will result in a considerable supply deficit for American utilities and undermine the construction of new reactors.

It is in this context that AREVA is planning to build its own enrichment plant, similar to the Georges Besse II plant currently under construction at the Tricastin site in southern France. This new plant will cost around 2 billion dollars to build and will use the centrifuge enrichment procedure developed by the Enrichment Technology Company (ETC). The site selection process is underway, with the final decision expected to be announced at the end of 2007. This announcement will be followed by the submission of a certification application to the NRC in the summer of 2008. The plant will have a production capacity of around 3 million SWU and should enter service in 2014, reaching maximum capacity in 2019.

The Reactors and Services Division – A leader in several fields

AREVA's second business division in terms of sales revenue in the United States, the Reactors and Services division specializes in the design and construction of new reactors and in the provision of services to existing power plants.

The group is currently the leader in the market for inspection and maintenance services carried out during scheduled outages, and for the supply and replacement of heavy components.



Highlights

- In 2007, AREVA provided services during scheduled outages at more than 30 U.S. PWR and BWR power plants.
- AREVA controls a significant part of the market for the maintenance of primary pumps and motors. To optimize service quality, it has invested 12 million dollars in the construction of a pump and motor maintenance workshop in Campbell County (State of Virginia).
- Also in 2007, AREVA replaced 1 steam generator and 2 reactor vessel heads.
- Since 2003, AREVA has manufactured 8 steam generators to replace existing equipment. It also holds 50% of the market for the manufacture and replacement of heavy components, such as steam generators, reactor vessel heads and pressurizers.
- AREVA supplied engineering services to support operating license extensions for more than 50% of all U.S. power plants.

A new training center to optimize service quality

To respond more fully to customer requirements and maintain its leadership position, AREVA has invested more than 3 million dollars in a technical training center in Lynchburg. Each year, this center provides high-level training to 1,000 nuclear technicians (in health physics, nuclear safety, repair activities, etc.). This facility sets a new standard on the American market.

EPR: a technology that has already been chosen by several American utilities

Alongside the development of service activities, the commercialization of EPR technology is a key focus for AREVA. EPR technology will be adapted to the local situation in the United States (temperature variations greater than those found in Europe, network frequency, etc.), hence the name of US EPR.

Given that electricity consumption is expected to have increased 50% by 2025, and assuming that nuclear energy continues to account for 20% of national electricity production, more than 30 new power plants will need to be built over the next 20 years. AREVA's objective is to supply one third of these new reactors.

Several utilities have already chosen EPR technology. 7 projects are underway, including:

- Constellation: Calvert Cliffs (Maryland) and Nine Mile Point (New York)
- Amarillo power: Amarillo (Texas) (2 units)
- Ameren: Callaway (Missouri)
- AEHI (Alternate Energy Holding): Bruneau (Idaho)
- PP&L: Susquehanna (Pennsylvania).

200 million dollars have been invested and a dedicated team of 325 engineers and 55 technicians have been mobilized for this certification application.

The next steps are:

- NRC analysis of the application and back-and-forth technical discussions, with a decision expected around 2010. In the interval, reviews in Finland and France should facilitate the NRC's work.
- Construction over a period of 5 years.
- Start-up of the first EPR in 2015.

UniStar Nuclear, an innovative business model

UniStar Nuclear is a U.S. joint venture established and jointly directed by Constellation Energy and AREVA. Its mission is to promote, market, certify and build the EPR in the United States in order to develop a standardized fleet of reactors. The EPR developed by AREVA is a 1,600 MWe model that meets all current requirements.

UniStar Nuclear chose the EPR as its reference technology in 2005 for 1 major reason: EPR was, and still is, the only 3rd generation reactor under construction in the world. This experience gives a tremendous advantage in terms of cost estimation, knowledge of licensing procedures and construction capacity.

EPR in the international competition

Two EPR are under construction on two sites:
- France: at Flamanville in the Normandy region for the utility EDF
- Finland: at Olkiluoto for the utility TVO.

In China, AREVA and the utility CGNPC signed on November 26th, 2007 the biggest contract ever in the history of nuclear power and entered into a long-term commitment. This record contract, worth 8 billion euros, is unprecedented in the world of nuclear market. Through a series of agreements, AREVA in conjunction with CGNPC will build two EPR reactors at Taishan site and provide all the materials and services required to operate them. An engineering joint venture will shortly be created. CGNPC agreed also to buy 35% of the production of UraMin, AREVa's subsidiary in the field of uranium production. At the same time, an agreement was signed between China and France opening the way to industrial cooperation in the back-end of the nuclear fuel cycle, notably for undertaking feasibility studies related to the construction of a spent fuel treatment-recycling plant in China.

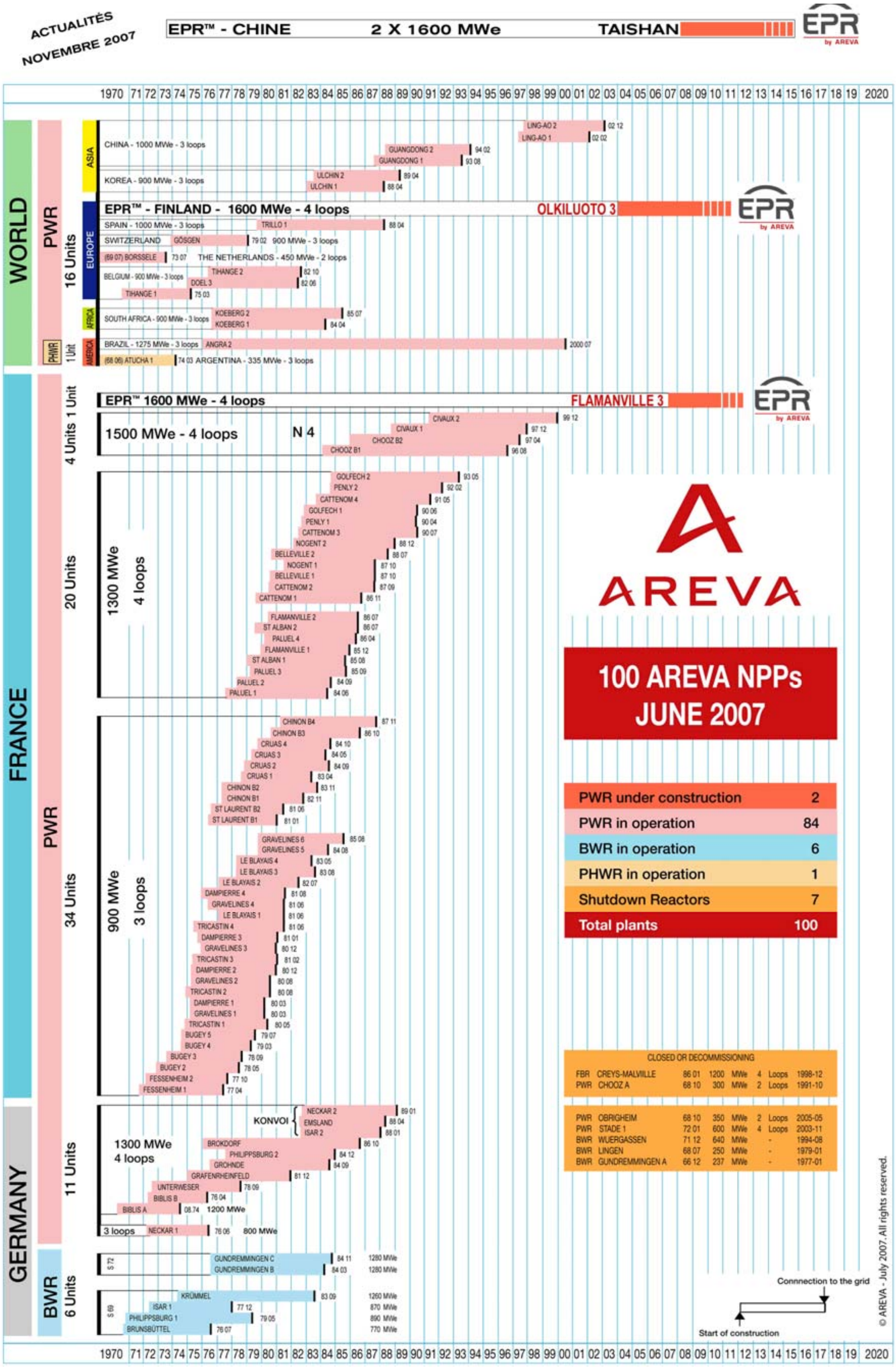
In the United Kingdom, on September 10, 2007, AREVA and EDF launched a joint website that presents the details of the EPR nuclear reactor. These details have been submitted to the UK regulators for design assessment.

In South Africa, AREVA has been selected by the government as Toshiba/Westinghouse for the feasibility study related to the building of two nuclear reactors, to be operated by ESKOM.

Construction of the EPR in Finland (November 2007)

Construction of the EPR in France (November 2007)

The 102 AREVA nuclear power plants



PWR under construction	2
PWR in operation	84
BWR in operation	6
PHWR in operation	1
Shutdown Reactors	7
Total plants	100

CLOSED OR DECOMMISSIONING

FBR	CREYS-MALVIILLE	86 01	1200	MWe	4	Loops	1998-12
PWR	CHOOZ A	68 10	300	MWe	2	Loops	1991-10
PWR	OBRIGHEIM	68 10	350	MWe	2	Loops	2005-05
PWR	STADE 1	72 01	600	MWe	4	Loops	2003-11
BWR	WUERGASSEN	71 12	640	MWe		-	1994-08
BWR	LINGEN	68 07	250	MWe		-	1979-01
BWR	GUNDREMMINGEN A	66 12	237	MWe		-	1977-01

With regard to AREVA TA (Technicatome), on September 25, 2007, the Board of Directors authorized the creation of a subsidiary of AREVA TA in the United States. Operating under the name of AREVA TA LLC (Limited Liability Company, equivalent to an S.A.R.L. in France), this subsidiary, established in Bethesda (Maryland) on November 6, will develop AREVA TA's operations in the field of industrial installation engineering (excluding nuclear propulsion). The subsidiary will, primarily, be responsible for service assignments involving inspection, consulting and prime contractor support for industrial operators in the nuclear energy cycle.

Synergy with the other subsidiaries of the AREVA group present in the United States has now been achieved thanks to recent work assigned to teams specialized in mechanical calculation. AREVA TA LLC will enable AREVA TA to develop valuable expertise in American standards and codes, an indispensable advantage when responding the needs of the civil nuclear market.

The Back End Division – recycling American fuel: AREVA and its industrial partners under contract with the DOE

As previously indicated, American policy has generally been favorable to an open cycle but is now turning towards a closed cycle. The expected change in U.S. policy towards the recycling of spent fuel should be confirmed by the DOE during 2008.

To accompany this change of direction, AREVA and its industrial partners – the Japanese companies MHI and JNFL (Japan Nuclear Fuel Limited) and the American companies WGI, BWXT and Battelle – obtained a DOE contract in October 2007 to study the development in the United States of a treatment facility for spent nuclear fuel and an advanced fast breeder reactor for the recycling of this waste. Four American engineers underwent training at the AREVA plant at La Hague.

Within the framework of this contract, the INRA industrial alliance, made up of the aforementioned partners and led by AREVA, must submit to the DOE:

- a description of the technologies proposed to meet GNEP strategic goals,
- a business model for the development, operation and marketing of the treatment facility and advanced fast breeder reactor,
- preliminary engineering studies for these 2 industrial installations.

AREVA and MHI will take responsibility for the technical development and design phase of the processing plant and reactor. JNFL, applying their experience gained at the Rokkasho Mura plant, will lead the safety studies for the treatment facility. Battelle will organize the presentation of technical data for the proposed technologies and procedures and will prepare the R&D plan. BWXT will be responsible for plant safety and will provide support during the certification activities conducted by the relevant safety authorities. Finally, WGI will provide engineering expertise.

The MOX project takes shape at Savannah River

Another DOE project undertaken by AREVA is the ongoing construction of a MOX fuel fabrication facility at the Savannah River site near Aiken, South Carolina, in partnership with the SHAW Group. This project is part of an agreement between the United States and Russia to decommission 34 metric tons of surplus defense-grade plutonium in each country by recycling it for civilian uses.

The facility's design draws heavily on AREVA's expertise developed at its La Hague and MELOX plants. Construction work began in summer 2007 and production is due to begin in 2016. Four test assemblies which were manufactured by AREVA at the Cadarache plant in 2004 and 2005 are currently fueling the Catawba power plant (North Carolina), operated by Duke Power. Feedback has been very positive (EUROFAB project).

Construction of Savannah River MOX plant (South Carolina)

A FORWARD-THINKING APPROACH FOR AREVA'S T&D DIVISION

Opportunities in grid modernization

This sector is AREVA's 3rd largest source of revenue in the United States. The next major challenge will be to develop the group's current positioning in a country which offers a number of real opportunities. The American electricity transmission and distribution market is currently valued at 7 billion dollars and enjoys annual growth of 4.5%.

The American network is aging (as was shown by the recent blackouts in California and New York) and its modernization will require significant investment.

Holy Cross Energy featuring AREVA T&D GIS (gas insulated switchgear)

After several years of under-investment in network infrastructure, operators are now ready to allocate considerable resources to new T&D equipment and lines.

Nevertheless, operators still face a number of challenges, particularly the increase in the cost of materials required for T&D equipment components and uncertainties concerning carbon emission regulations.

AREVA 's Transmission and Distribution activities in the United States

AREVA has 5 production sites and several commercial offices in the United States and employs almost 790 people:

- Charleroi (Pennsylvania), specialized in high voltage circuit breakers, employs 175 people;
- Bethlehem (Pennsylvania) produces automation products for instrumentation systems and protection relays. It employs 65 people;
- Waynesboro (Georgia) employs 180 people and manufactures instrument transformers;
- Redmond (Washington) employs 300 people. This site also houses our global skill center for energy management systems automation;
- Philadelphia (Pennsylvania) employs 65 people and produces power electronics systems.

AREVA’s electricity transmission and distribution products

In America, AREVA is a market leader in automation and information systems designed for electricity transmission and distribution. 65% of major utilities use one or more products produced by AREVA’s T&D division.

AREVA products can be found in the strategic infrastructure architecture of the American electricity sector, especially in the high voltage sector (e.g. circuit breakers manufactured by the Charleroi plant) and automation sector. The acquisition in July 2006 of Ritz High Voltage, a world leader in transformers, completed AREVA’s products offering in the highly-specialized high voltage sector.

The group’s remote grid operating systems channel 40% of the electricity that is distributed across the country. 65% of electricity utilities use at least one of these products.

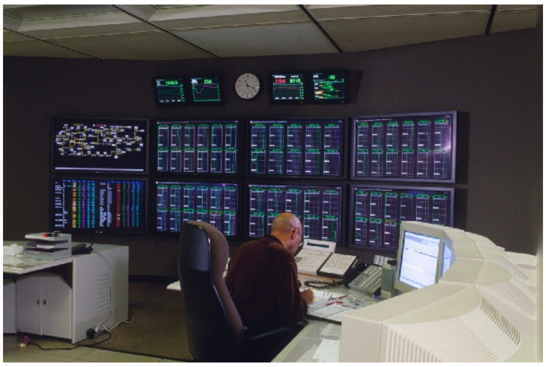
At Redmond, AREVA has developed expertise in software and information systems that is being expored around the world. A partnership with Microsoft to facilitate the visualization of grid data has helped improve the group’s ability to innovate and the quality and competitiveness of its products.

AREVA T&D’s main clients in the United States are major utilities and network operators (as PJM, network actor operating in the North-East of the country) as well as industrial groups such as Chevron.

Highlights

- AREVA leads the transmission system management market.
- Two thirds of American utilities use AREVA products for their transmission networks.
- Close collaboration between AREVA and suppliers of renewable energy solutions – mainly wind power – to ensure their connection to electricity grids.
- In 2006, AREVA was contracted by PJM to guarantee the reliability of an interconnection system linking over 6,000 substations and supplying 51 million people across 14 states in the United States.
- In February 2007, AREVA won a contract with Northeast Utilities to supply 14 high voltage transformers as part of a major reinforcement project for grid in northeastern America.

Georgia Transmission Company featuring AREVA T&D 550 kV circuit breakers



Ameren featuring AREVA T&D energy management system software in their control room

ANNEX: THE EPR REACTOR

The EPR advanced nuclear reactor

The EPR was developed by Framatome and Siemens KWU (the nuclear division of Siemens), whose nuclear activities were combined in January 2001 to form Framatome ANP, now AREVA NP. The French electricity utility EDF (Electricité de France), together with the major German utilities, played an active role in the project. The safety authorities of the two countries joined forces to bring their respective safety standards into line and draw up joint design rules for the new reactor. EPR complies with the safety standards laid down by both the French and German safety authorities for future pressurized water reactors. EPR meets the "European Utility Requirements." This specification was drawn up by electricity companies in Belgium, Finland, France, Germany, Great Britain, Italy, Holland, Spain, Sweden, and Switzerland. The "European Utility Requirements" also make allowance for the specifications of operators in the United States, drawn up under the aegis of the Electric Power Research Institute (EPRI).

Main characteristics of EPR

The EPR is a pressurized water reactor based on the most recent technologies: the French N4 reactors in operation at Chooz and Civaux Nuclear Power Plants, and the Konvoi reactors in operation at Neckarwestheim 2, Emsland, and Isar 2 in Germany. The EPR benefits from over thirty years operating feedback from nuclear power plants. AREVA has built more than 90 nuclear reactors, representing almost 30% of the total installed nuclear power capacity worldwide.

The EPR is an evolutionary product. It is based on pressurized water reactor technology that is currently the most widely used with 264 reactors in operation out of a total of 435. pressurized water reactors account for 56% of the total installed capacity worldwide.

As a new-generation reactor, the EPR affords significant economic and technical progress: enhanced safety level, reduced volumes of long-lived waste, considerable reduction in the doses received by operating and maintenance personnel, and reduced electricity production costs (better use of fuel, improved availability, higher operating flexibility, and fewer maintenance constraints).

EPR: an even more competitive reactor

With the EPR, it will be possible to generate electricity at an even lower cost than that of electricity generated in most recent reactors. The savings will be made thanks to the optimization of a number of major factors.

The electrical power of the EPR (around 1,600 MWe) is higher than that of the most recent plants (around 1, 450 MWe). The service life of the EPR has been extended to 60 years rather than 40 years for the previous reactors. Better use is made of fuel. With the EPR, 17% less uranium is required to generate the same amount of electricity, thereby, reducing the volume of waste. Costs are, therefore, lower for the entire fuel cycle from enrichment to reprocessing. The general layout of the equipment is designed to provide easier access and simplify maintenance operations that are consequently carried out more rapidly. Routine maintenance of safety-related systems can be carried out without shutting down the plant. The length of the scheduled refueling outage has been shortened to allow an increase of reactor availability – over 90%.

With the EPR, the cost of the electricity generated will be significantly lower than the cost of electricity generated using gas, the main rival energy source. Nuclear is the only electrical source, other than hydro, that incorporates in the kilowatt hour all the external costs for waste disposal and decommissioning.

EPR: an even higher level of safety

Safety in the nuclear industry is an integral part of continuous progress. Pressurized water reactors are extremely safe industrial facilities, and their high level of safety has been increased even further with the EPR.

The safety functions are performed by a variety of simple, redundant systems. They are more highly automated. Each of the main safety systems is subdivided into four identical subsystems that perform the same function when an abnormal operating situation occurs, in particular to cool the core, thus ensuring that the safety function is always performed. The subsystems are totally independent and are kept strictly separate by being housed in four different buildings. Thus, whenever the slightest fault occurs in one system due to internal (flooding, fire, etc.) or external incidents, another system can take over and perform the necessary safety function.

In line with the requirements of the French and German safety authorities, the initial designs of the EPR made allowance for a military aircraft impact scenario. In the September 11 context, the call for bids launched in 2002 by Finland for its fifth reactor demanded that candidate models must be capable of withstanding an impact by a commercial aircraft. The EPR designs were, therefore, upgraded with extra thickness and provided scope for these modifications without any effect on the fundamental design of the EPR.

In the highly unlikely event of core damage occurring, measures have been taken to protect the public and the environment from all possible consequences. Even if a core melt should occur, the molten core (“corium”), after melting through the reactor vessel wall, would be contained in a dedicated spreading compartment. This compartment is then cooled to remove the residual heat. With the EPR, this type of extreme core melt would not extend beyond the reactor containment. The vicinity around the plant, the subsoil, and the water table would be fully protected.

MAIN ACRONYMS

- **COL : Combined Construction and Operating License**
- **DOE : Department of Energy**
- **EPRI : Electric Power Research Institute**
- **GNEP : Global Nuclear Energy Partnership**
- **NRC : Nuclear Regulatory Commission**

REFERENCES

- ***Key World Energy Statistics,*** International Energy Agency, 2007.
- ***Energy Balances of OECD Countries***, International Energy Agency, 2007.
- ***The BP Statistical Review of World Energy***, 2007.
- ***US Nuclear Power Industry,*** site web http://www.world-nuclear.org/info/inf41.html, World Nuclear Association, December 2007.
- ***Site web*** http://www.nei.org/, Nuclear Energy Institute, December 2007.
- ***Site web*** http://www.eia.doe.gov/, Energy Information Administration, DOE, December 2007.
- ***Nuclear Data***, OECD Nuclear Energy Agency, 2007.
- ***NUKEM Market Report***, NUKEM inC., October 2007.

With manufacturing facilities in 41 countries and a sales network in more than 100, AREVA offers customers reliable technological solutions for CO_2-free power generation and electricity transmission and distribution. We are the world leader in nuclear power and the only company to cover all industrial activities in this field.

Our 61,000 employees are committed to continuous improvement on a daily basis, making sustainable development the focal point of the group's industrial strategy. AREVA's businesses help meet the 21st century's greatest challenges: making energy available to all, protecting the planet, and acting responsibly towards future generations.

www.areva.com

AREVA
33 rue La Fayette - 75009 Paris - France
Tel.: +33 (0) 1 34 96 00 00 - Fax: +33 (0) 1 34 96 00 01
www.areva.com

Energy is our future, don't waste it !